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# Multidisciplinary pulmonary embolism care: an exciting time to join the team.

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# Multidisciplinary pulmonary embolism care: an exciting time to join the team

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Pulmonary embolism (PE) remains a major cause of morbidity and mortality in hospitalized patients and is a top cause of cardiovascular death behind myocardial infarction and stroke, two disease states which have seen the formalization of team-based care that can be rapidly activated and deployed for expeditious and expert treatment.[1] Only recently in this decade, and in conjunction with the advances of new therapeutic options for PE including catheter-directed thrombolysis and thromboaspiration, have we seen the emergence of the PE Response Team (PERT) in an attempt to improve care for this deadly disease. First described by Massachusetts General Hospital and in operation since 2013, the PERT is modeled off of the deployment of Rapid Response Teams meant to bring specialized resources to hospitalized patients in an effort to rescue and prevent further deterioration. The team can be rapidly activated and expert care from multiple stakeholder specialties can be planned and coordinated with the patient and primary physician.[2–4] Modeled after this team approach, PERTs have rapidly spread in hospitals across America and, in 2015, the PERT Consortium® was created to help focus ongoing mission goals, including the creation of registry data on patients treated under this care model. At the time of publication, the PERT Consortium® comprises over 60 founding and institutional member hospitals.[5]

In this issue of *Pulmonary Circulation*, Jacob Schultz and colleagues describe the first-year experience of the original eight large tertiary care centers participating in the PERT Registry. In this report, the authors describe characteristics of PERT activations, with a variety in frequency of activations between hospitals and hospital wards. Characteristics of PE are described in terms of presence of right heart strain by biomarker, radiographic or echocardiographic evidence and stratified by risk classification according to European Society of Cardiology guidelines. A variety of treatment options were employed including anticoagulation alone in the majority as well as advanced therapy including systemic or catheter-directed thrombolysis, catheter-directed thromboaspiration, surgical embolectomy, Extracorporeal Membrane Oxygenation, or inferior vena cava filter placement. Finally, event rates for 30-day mortality, major bleeding, and recurrent venous thromboembolism (VTE) are reported and stratified by risk category.[6]

This report brings the first multicenter analysis of PERT registry data and highlights some of the phenomena that we in practice in high-volume centers know to be true. However, it leaves some unanswered questions that, hopefully, pooled consortium data will rapidly clarify.

The PERT composition is not a one-size-fits-all team and, just as diverse as the patient populations described, must be tailored to a hospital's capabilities and its population's needs. Our PERT has isolated physician champions in core subspecialties of Pulmonary/Critical Care Medicine, Pulmonary Hypertension, Advanced Heart Failure Cardiology, Cardiac Surgery, Interventional Cardiology, and Interventional Radiology. Emergency Physicians and Internist experts with an interest in anticoagulation contribute to our team with additional support from Vascular Surgery and Hematology. Notable in this study is a marked difference in location of activation of the teams between hospitals, suggesting the ongoing need for individualized team structure and underscoring the importance in careful scrutiny of quality improvement measures that are integral to each team's success.

The question on every practitioner's mind at this point is addressed but unfortunately not answered by the limited amount of data presented: outcomes for advanced therapy compared to anticoagulation alone. As reported previously in the initial single-center experience, pooled major bleeding was similar between the groups treated with anticoagulation alone and patients treated with catheter-based techniques, adding important safety data to the evidence base. However, the low event rate in both studies suggests under-powering of the data that will likely require a large registry to answer.[2,6] This study also points out that in the PERT population, recurrent VTE events occur equally across risk groups, but appeared to trend higher in groups treated with catheter-based strategies and systemic thrombolysis for unclear reasons.[6]

Perhaps the presence of a PERT in a hospital selects out a different population of patients than previously studied. The pooled mortality rates are markedly varied between the study sites and, with additional data, may be correlated potentially with outside hospital transport to the study hospital specifically for PERT service or activation from the intensive care unit, postoperative or oncology wards, suggesting a higher prevalence of co-morbid conditions contributing to overall outcome, but at present the population size did not allow for analysis of co-morbid factors. Our own PERT experience parallels this suggestion; with the growth of our program, a wider case mix of patients is following and special challenges in inter-hospital transport and increasing acuity have brought a selected and ultimately sicker population to our care.

The reported 30-day mortality for each risk group was higher than previously reported before the PERT era.[7] Most striking, mortality in the low-risk group was 11%, compared to 0.5% in the previous prediction model.[6,7] The authors introduce the concept of a low-risk patient with high-risk features. These patients may have initially come to the attention of the multidisciplinary team for complex management of co-morbidities. Additionally, the present ESC classification does not take into account common features including saddle PE, clot in transit, syncope, or predicted difficult anticoagulation in co-morbid or post-operative patients—conditions which may bring more risk than suggested by PE severity indices and initial clinical stratification data. Low-risk co-morbid patients may have features that complicate accurate stratification. These patients often come to the attention of the PERT based on primary provider concern for these features and their implication on outcomes. The rapid assessment and decision support provided by the multidisciplinary team for low-risk patients with high-risk features is, in our experience, valuable to the bedside clinician and, given the mortality data in this patient population, appears to be an important area for need of ongoing research that may lead to altogether refined stratification definitions.

The authors' reporting on the number of PERT activations is thought-provoking to any clinician interested in starting a PERT program. The average reported dosing of calls is eight per month per 1000 beds, but variable among the institutions.[6] Depending on resources, each call involves physicians of multiple specialties during non-traditional hours in teleconference; time commitment for clinical and administrative duty is immense. This care coordination and increased on-call burden often goes largely uncompensated, with only procedural and clinic downstream revenue for some of the team providers. The asymmetric returns are often not appreciated at the point of team creation and require significant time and capital investment, but when realized, are immense. Our team receives positive feedback on the collaboration our cross-functional group can provide for decision support on complex patients and we feel pride in our high-quality multidisciplinary care. Formalized PERT clinic follow-up has allowed for the earlier detection and treatment of chronic thromboembolic pulmonary hypertension (CTEPH), a devastating but potentially curable sequela, when found early. Participation in the PERT Consortium has brought us together with like-minded physicians across the country interesting in advancing care.

The data provided by Schultz and colleagues is an exciting beginning to a new era of PE research. Coordinated care for complicated patients done in high-quality centers may finally pool together, by way of the PERT registry, the powered data necessary to answer the ongoing questions in our field. Are our current risk stratification guidelines accurate in predicting outcome? Who benefits from advanced therapy and can we impact morbidity and mortality? Do our expanded care options or post-PE follow-up help us earlier identify long-term sequelae of acute PE including the Post-PE syndrome and CTEPH? The PERT consortium members are well primed to carry out multicenter prospective trials to additionally help guide future therapies. Amid these questions, a point of clarity exists in the rapid growth of PERT driven therapy for this complicated and heterogeneous disease state, and a wealth of information will be obtained to advance the care of our patients.

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